PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

BRITISH COLUMBIA

A Reconnaissance Survey Of Upper Tenakihi Lake

M. J. Hunter
March 1997

PWFWCP Report No. 165

105-02066/

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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A RECONNAISSANCE SURVEY OF

UPPER TENAKIHI LAKE

WATERSHED:	**Williston Reservoir (Finlay Reach)**
DATE OF SURVEY:	**September 24 - 25, 1996**
FIELD CREW LEADER:	**Mark Hunter**
FIELD ASSISTANT:	**Karin Mathias**
REPORT PREPARED BY:	**Mark Hunter**

BRITISH COLUMBIA CONSERVATION FOUNDATION

PEACE / WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B. C. MINISTRY OF ENVIRONEMNT, LANDS AND PARKS

FUNDED BY: FOREST RENEWAL BRITISH COLUMBIA

RELEASED BY: _____

D. J. Cadden, Regional Fisheries Biologist

LAKE: Upper Tenakihi Lake **SYSTEM NAME: Osilinka River**

A.S.A.P. REFERENCE NO.: **WATERSHED CODE: 238-0240-403**

DATA ON FILE FOR THIS SURVEY

Location	X	Dissolved 02 / Temp. Profiles	X
Physical Data	X	Winter Dissolved 02 / Temp. Profiles	--
Bench Mark	X	Netting Record	X
Terrain Features	X	Lake Catch Summary	X
Access	X	Individual Fish Data	--
Resorts and Campsites	X	Fish Preserved	--
Other Developments	X	Stomach Analysis	--
Obstructions and Pollutions	X	Scale Reading	--
Special Restrictions	X	Location of Inventory Sites	X
Aquatic Plants	X	Photograph Directory	X
Wildlife Observations	X	Appendices	
Miscellaneous Comments	X	A: Water Chemistry Analysis	X
Lake Drainage	X	B: Tributary Stream Data	X
Fisheries Management Comments	X	C: Fish Scale Analysis	--
History of Previous Surveys	X	Bathymetric Map Reduction	X
Water Chemistry Summary	X	Bathymetric Map	--

LOCATION

Location:	approximately 177 km northwest of Mackenzie		
Elevation:	1210 m ± 10 m	U.T.M.:	10.347277.6228669
Latitude / Longitude:	56°10'43" 125°27'37"	N.T.S. Map No.:	94 / C - 8
Management Unit:	7-38	Biogeoclimatic Zone:	Boreal White & Black Spruce
Ecoprovince:	Sub-Boreal Interior	Ecoregion:	Omineca Mountains
Ecosection:	Southern Omineca Mountains		

Drainage: Tenakihi C. --> Middle Tenakihi L. --> Tenakihi C. --> Lower Tenakihi L. --> Tenakihi C. --> Osilinka R. --> Williston Reservoir (Osilinka Arm - Finlay Reach) -->. Peace R.

PHYSICAL DATA

Lake Drainage Area:	42.9 km^2	Volume:	3 992 932 m^3
Water Surface Area:	432 707 m^2	Perimeter of Islands:	0 m
Area Above 6 m Contour:	164 123 m^2	Number of Islands:	0
Shoreline Perimeter:	4 266 m	Mean Depth:	9.2 m
Maximum Depth:	25.0 m	Secchi Reading:	11.35 m
Filterable Residue (TDS):	30 mg/L		

Sounding Device: Lowrance X-15 Elevation Source: Contour Interpolation

BENCHMARK

(Iron spike, center of red circle) located 2.0 m above present water level in a 32 cm diameter spruce tree that is 5.5 m from the present water's edge and located on the west-northwest side of the lake approximately 60 m from the northeast end of the lake (Plate # 5).

High Water Mark: 0.2 m above water level at time of survey

TENAKIHI
94-c/8
S—W
OSILINKA
RANGES
~165km to Mackenzie
THANE

LAKE: Upper Tenakihi Lake

TERRAIN FEATURES

Immediate Shoreline:

Upper Tenakihi Lake is fronted on the northwest and southeast sides by a beach of varying amounts of gravels, cobbles and boulders, with spruce, lodgepole pine and fir trees, and willows, scrub birch and pink mountain heather growing behind on low slopes. The exceptions to this is along the southwest side of the lake, which has a steep slope away from the lake, and along the west side of the lake, which has a moderately steep slope away from the lake. The southwest end of the lake is fronted by common red sphagnum moss with sedge grasses and spruce trees growing on a low slope. The northeast end of the lake is fronted by a open area covered in moss and scrub birch.

From the Upper of the northwest side of the lake, clockwise to the south side of the lake, the shoreline substrate is composed of gravels, cobbles and boulders overlain with fines. The exception to this is in the north corner of Upper Tenakihi Lake, where the shoreline substrate is composed of fines and organics. On the other sides of the lake, the shoreline substrate is composed of fines and organics, except in front of where Tenakihi Creek enters the lake in the southwest end of the lake. The shoreline substrate here is gravels and fines. The lake's bottom drops off steeply towards the center of the lake along the northwest, southwest and southeast sides of the lake. Along the northeast side of Upper Tenakihi Lake, the lake's bottom has a moderately low slope towards the center of the lake. There is lots of large woody debris found along the northwest and southeast sides of the lake.

Surrounding Country:

Upper Tenakihi Lake is surrounded by a mature forest of spruce trees, with some lodgepole pine, fir and paper birch trees intermixed. To the northwest and southeast, the lower slopes rise up to craggy mountains. To the northeast and southwest of the lake, the land is relatively flat with mountains in the far distance. Upper Tenakihi Lake is situated within the Boreal White and Black Spruce biogeoclimatic zone.

LAKE: Upper Tenakihi Lake
ACCESS

Directions:

From it's junction with Highway 39, drive south on Highway 97 for approximately 1.5 km, and turn right on to the Finlay Forest Service Road. Travel north for approximately 173 km, then turn left on to the Osilinka Forest Service Road. Proceed for approximately 46.5 km to Osilinka Camp. The total distance from the junction of Highway 97 and Highway 39, the total distance to Osilinka Camp is approximately 221 km. Upper Tenakihi Lake is approximately an 19.5 km helicopter ride west-northwest of Osilinka Camp.

Road Type and Conditions:

Highway 97 is a well-maintained, two-lane paved provincial highway. The Finlay Forest Road and the Osilinka Forest Service Road are both well-maintained, two-lane gravel logging roads that are easily traveled with a two-wheel drive vehicle during the summer.

Restrictions:

Although there are no restrictions, it is recommended that a truck radio be used when traveling on the gravel roads.

RESORTS AND CAMPSITES

There are no resorts or campsites located on Upper Tenakihi Lake.

OTHER DEVELOPMENTS

There was a cabin built approximately 500 m downstream of Upper Tenakihi Lake. It appeared that the cabin was used by a trapper - there were traps and horse tack in the cabin.

OBSTRUCTIONS AND POLLUTIONS

None noted.

LAKE: Upper Tenakihi Lake

SPECIAL RESTRICTIONS

None known.

AQUATIC PLANTS

The following aquatic plants were identified during the time of the survey:
waterweed (Anacharis sp.)
sago pondweed (Genus sp. name)

WILDLIFE OBSERVATIONS

The following wildlife or signs were seen during the time of the survey:

3 moose
2 unidentified ducks
bear tracks
muskrat
gray jay & other various songbirds

MISCELLANEOUS COMMENTS

1) The aquatic vegetation in Upper Tenakihi Lake was very sparse.

2) There is a good location for a Forest Recreation Site on the northeast end of the lake.

3) A helicopter can easily land on the gravel beach located on the northeast end of the lake.

4) Bathymetric map: The lake outline was drawn from an enlargement of air photo 30 BCB 93025, No. 068, flown August 5, 1993.

LAKE: Upper Tenakihi Lake

LAKE DRAINAGE

General:

Upper Tenakihi Lake is fed by eight inlets, one of which is Tenakihi Creek, and an additional twenty intermittent inlets. The lake is drained to the northeast by the continuation of Tenakihi Creek, which flows for approximately 1.2 km to Middle Tenakihi Lake. This lake is drained to the northeast by Tenakihi Creek which flows for approximately 2.6 km to a small unnamed lake, from which Tenakihi Creek continues out of and runs for approximately 2 km to Lower Tenakihi Lake. Tenakihi Creek continues downstream of this lake for approximately 26 km to it's confluence with the Osilinka River.

Major Systems:

Inlet # 1 - Tenakihi Creek

Tenakihi Creek enters Upper Tenakihi Lake in the southwest end of the lake (Plate # 6). Over the first 100 m upstream of the lake, the channel is braided with lots of side channels. Approximately 100 m upstream of the lake, the braids converge to form a single channel. Approximately 130 m upstream of Upper Tenakihi Lake, there is a 0.4 m high beaver dam that has been partially breached. Over the first 200 m upstream of the lake, the substrate is mainly gravels with some cobbles and fines. The banks are approximately 0.5 m high and composed of fines, gravels and small cobble covered by mosses, grasses, scrub birch and spruce trees. Upstream of 200 m, the substrate changes to include more cobbles than gravels. Approximately 250 m upstream of Upper Tenakihi Lake, there is a debris jam that will not hinder fish passage.

A Stream Survey card was completed for a sample site located approximately 300 m upstream of Upper Tenakihi Lake (Plates # 7 & # 8). The average wetted width is 8.5 m and the average maximum riffle depth is 0.5 m. The substrate is composed of cobbles (65%), gravels (25%) and fines (10%). The creek morphology is mainly runs (60%) with some riffles and pools (20% each), and has a gradient of 3%. The water temperature at the time of the survey was 3 °C. For additional information, refer to Appendix B.

Outlet - Tenakihi Creek

Upper Tenakihi Lake is drained from the northeast end of the lake by Tenakihi Creek. Over the first 400 m downstream of the lake, the creek has an average wetted width of 14.5 m and depth of 0.3 m. The substrate is mainly gravels, with some fines, cobbles and boulders, and lots of green algae growing in the creek. The right bank (looking upstream) is 0.4 m high and composed of fines, gravels and small cobble covered by mosses,

grasses, willows and some spruce trees. The left bank increases in height rapidly to approximately 20 m, and is composed of exposed fines, gravels and cobbles. From 400 m to 560 m downstream of the lake, the channel narrows down to an average wetted width of 8.0 m and depth of 0.35 m. The substrate is very similar to the prior section, but there is less green algae growing in the creek. Approximately 530 m downstream of the lake, the left bank decreases in size and becomes similar to the opposite bank; the banks remain fairly constant downstream of this point. From 560 m to 670 m downstream of Upper Tenakihi Lake, the channel widens to an average wetted width of 12.0 m and an average depth of 0.7 m. The substrate is composed mainly of fines (70%) with some gravels, cobbles and boulders. The flow decreases, and the channel is braided around a few islands of sedge grasses as well. From 670 m to 820 m downstream of the lake, the channel narrows to an average wetted width of 8.0 m with an average depth of 0.3 m. There are some pools located along this section of the creek that are deeper than 1.0 m. From 820 m to 950 m downstream of the lake, the substrate is composed of small cobbles and gravels - this is mainly large gravels. From 950 m to 1085 m downstream of Tenakihi Lake Northeast, the creek has an average wetted width of 13.0 m and depth of 0.3 m. The substrate changes to contain more gravels than small cobble, and there is some fines and large cobble. Some large woody debris has fallen into the channel. Approximately 1085 m downstream of Upper Tenakihi Lake, the creek is braided for 15 m before it enters Middle Tenakihi Lake.

A Stream Survey card was completed for a sample site located approximately 300 m downstream of Upper Tenakihi Lake (Plates # 9 & # 10). The average wetted width is 14.5 m and the average maximum riffle depth is 0.3 m. The substrate is composed of gravels (60%), fines (20%), cobbles (15%) and boulders (5%) with green algae growing on the bottom of the creek. The creek morphology is riffles and runs (50% each) with a gradient of 1.5%. The water temperature at the time of the survey was 10 °C. For additional information, refer to Appendix B.

A Stream Survey Card was completed for a second sample site located approximately 925 m downstream of Upper Tenakihi Lake (Plate # 11). The average wetted width is 19.5 m and the average maximum riffle depth is 0.3 m. The substrate is composed of gravels (55%), cobbles (35%) and fines (10%). The creek morphology is mainly runs (55%) and riffles (40%) with a gradient of 1.5%. The water temperature at the time of the survey was 7 °C. For additional information, refer to Appendix B.

Approximately 900 m downstream of Upper Tenakihi Lake, there is an inlet to Tenakihi Creek that enters on the left hand side (looking upstream). This creek has an average wetted width of 1.8 m and depth of 0.1 m. The substrate is composed of cobbles (60%), gravels (30%) and fines (10%). The water temperature at the time of the survey was 4 °C.

LAKE: Upper Tenakihi Lake

Minor Systems:

Inlet # 2 - Unnamed Creek

Inlet # 2 enters Upper Tenakihi Lake near the outlet on the east side of the lake (Plate # 12). The creek has an average wetted width of 0.7 m and depth of 0.1 m. The substrate is composed of fines and small gravels with lots of small woody debris in the creek. The banks are composed of moss covered boulders and fines. Approximately 20 m upstream of the lake, the creek braids. Upstream of the braid point, there are some small falls on both braids. Inlet # 2 had no fisheries potential during the survey period.

Inlet # 3 - Unnamed Creek

Inlet # 3 enters Upper Tenakihi Lake near the outlet on the east side of the lake (Plate # 13). The creek has an average wetted width of 0.6 m and a maximum depth of 0.1 m. The substrate is composed of fines, gravels and cobbles with lots of large woody debris fallen in to the channel. The banks are very low and covered by mosses. Back from the lake, the creek flows down a steep slope (12.5%). Inlet # 3 had no fisheries potential during the survey period.

Inlet # 4 - Unnamed Creek

Inlet # 4 enters Upper Tenakihi Lake near the Upper of the southeast side of the lake (Plate # 14). The creek has an average wetted width of 0.8 m and a maximum depth of 0.25 m. The substrate is composed of fines, gravels and cobbles with some woody debris. The creek is held by low banks covered by mosses, willows and some spruce trees. Back from the lake, the creek has a gradient of 12%. Inlet # 4 had no fisheries potential during the survey period.

Inlet # 5 - Unnamed Creek

Inlet # 5 enters Upper Tenakihi Lake on the south side of the lake. The creek has an average wetted width of 0.5 m and depth of 0.02 m. The substrate is composed of fines, gravels and cobbles. The banks are very low and covered by mosses. The creek flows down a very steep hill (gradient of 43%). Inlet # 5 had no fisheries potential during the survey period.

Inlet # 6 - Unnamed Creek

Inlet # 6 enters Upper Tenakihi Lake in the southwest end of the lake (Plate # 15). The creek has an average wetted width of 5.0 m and depth of 0.5 m. The substrate is composed of fines and organics. The banks are composed of fines overgrown by sedge grasses and willows. Approximately 30 m upstream of the lake, there is a 0.65 m high beaver dam that was probably not passable to upstream fish movement at the time of the survey due to lack of sufficient flow over the top of the dam (Plate # 18). Approximately

55 m upstream of the lake, there is a second beaver dam that is 0.55 m high. This dam was probably not passable to upstream fish movement at the time of the survey for the same reason as the previous dam. Inlet # 6 had no fisheries potential during the survey period.

Inlet # 7 - Unnamed Creek

Inlet # 7 enters Upper Tenakihi Lake on the northeast side of the lake (Plate # 16). Over the first 10 m upstream of the lake, the creek has an average wetted width of 1.0 m and depth of 0.03 m. The substrate is composed of small and large gravels with some fines. The creek is held by 0.3 m high banks composed of fines and gravels covered by mosses and willows. Approximately 10 m upstream of the lake, the creek changes to have an average wetted width of 1.3 m and depth of 0.2 m. The substrate is composed of fines and organics over gravels. Approximately 35 m upstream of the lake, the creek goes underground. Inlet # 7 had no fisheries potential during the survey period.

Inlet # 8 - Unnamed Creek

Inlet # 8 enters Upper Tenakihi Lake on the northeast end of the lake (Plate # 17). The creek has an average wetted width of 2.0 m and depth of 0.35 m. There are some pools that are 0.8 m deep. The substrate is composed of gravels and cobbles with some fines. The banks are 0.3 m high and composed of fines, gravels and some cobbles covered by mosses and willows. Approximately 150 m upstream of the lake, the creek braids around a central bar with willows and spruce trees growing on it.

A Stream Survey card was completed for a sample site located approximately 100 m upstream of Upper Tenakihi Lake (Plate # 18 & # 19). The average wetted width is 3.0 m and the average maximum riffle depth is 0.35 m. The substrate is composed of gravels (45%) and cobbles (45%) with some fines (10%). The creek morphology is mainly riffles (60%) and runs (30%) with some pools (10%) that has an average maximum depth of 0.7 m. The gradient is 3% and the water temperature at the time of the survey was 1.5 °C. For additional information refer to Appendix B.

Intermittent Inlets - Unnamed Creeks

There are twenty intermittent inlets that enter Upper Tenakihi Lake at various points around the lake. The average wetted widths vary between 0.3 m and 1.0 m, and the average depth vary between 0.02 and 0.05 m. The substrate is composed of various amounts of fines, gravels and cobbles. Each of the intermittent inlets go underground between 5 m to 50 m upstream of the lake. None of the intermittent inlets had any fisheries potential during the survey period.

LAKE: Upper Tenakihi Lake

FISHERIES MANAGEMENT COMMENTS

Upper Tenakihi Lake appeared to be almost barren of all fish species. Only one sculpin was caught in four Gee minnow traps and one experimental monofilament gill net set overnight. There did appear to be a good food base in the lake, consisting of such things as caddis fly larvae and other aquatic insects. As well, there was good to excellent spawning habitat found in Tenakihi Creek both upstream and downstream of the lake, and in Inlet # 8. The lake is 24.0 m deep, and the summer oxygen / temperature profile indicated that there are excellent levels of dissolved oxygen throughout the water column -the reason for this maybe that the lake had just turned over. The pH averaged 7.55 (field) from top to bottom, which is suitable for sustaining a fish population. Upper Tenakihi Lake is a prime candidate for a stocking program. Because this lake appears to be almost barren of all fish species, as is the lake immediately downstream, this could be an excellent system to be stocked with an Arctic grayling population as there would be no aquatic predators. If Arctic grayling were used, they could be caught in either the Osilinka or Mesilinka Watersheds to prevent the introduction of a new stock of Arctic grayling into the Osilinka River if any fish did move downstream. There is a trappers / guide outfitters cabin located approximately 400 m downstream of Upper Tenakihi Lake - if the lake was stocked with Arctic grayling, the owner of the cabin may be notified at the discretion of the stocking agency so as to prevent the owner from fishing in the lake. There is a good location for a Forest Recreation Site located on the northeast end of the lake. Upper Tenakihi Lake is situated within a valley between mountains, which makes the lake and surrounding country very pleasing to the eye. A large set of falls, approximately 10 m maximum in height, was located approximately 8 km to 9 km downstream of Upper Tenakihi Lake. These falls are probably the reason why the lake was barren.

HISTORY OF PREVIOUS SURVEYS

Lake Surveys:

None known.

Other Related Studies:

None known.

LAKE: Upper Tenakihi Lake

WATER CHEMISTRY SUMMARY **Limnology Station No. 1**

Field Conditions:

Date:	September 25, 1996		
Time:	1330 hrs	Air Temperature:	7.0 °C
Wind Velocity:	10 - 15 km/h	Wind Direction:	from the NE
Cloud Cover:	10 / 10 o.c.	Surface Conditions:	small - medium waves
Secchi Disc:	11.35 m	Water Colour:	clear with green tinge

Method Used:

Dissolved Oxygen:	YSI Model 57 Oxygen / Temperature Meter
Water Temperature:	YSI Model 57 Oxygen / Temperature Meter
Air Temperature:	Hand-Held Alcohol Thermometer
pH (field):	Digital pH Pocket Tester
H2S (field):	Hach H2S Field Test Kit
Laboratory Used:	Pacific Environmental Science Center
Water Sampler:	Vertical Alpha Water Bottle (Vandorn)
Metal Sampler:	By Hand; Preserved With 2.0 mL Nitric Acid
Substrate Sampler:	Substrate Sample Not Taken

Water Sample Chemistry: **SEAM Site No.:**

	Sampling Depths	
	Surface (0.5 m)	Lower (23.0 m)
Alkalinity (lab)	19.4 mg / L	19.7 mg / L
Filterable Residue 105°C (lab)	30 mg / L	30 mg / L
H2S (field)	N/A	0.0 mg / L
Nitrogen - Total (lab)	0.02 mg / L	0.03 mg / L
Non-Filterable Residue (lab)	< 5 mg / L	5 mg / L
pH (field)	7.6	7.5
pH (lab)	7.50	7.48
Phosphorus - Total Dissolved (lab)	0.004 mg / L	0.004
Specific Conductance (lab)	50 µS / cm	51 µS / cm

Bottom Depth: 24.0 m

Substrate Sample Depth: N/A

* additional analyzed parameters and results, including metals, are found in Appendix 1

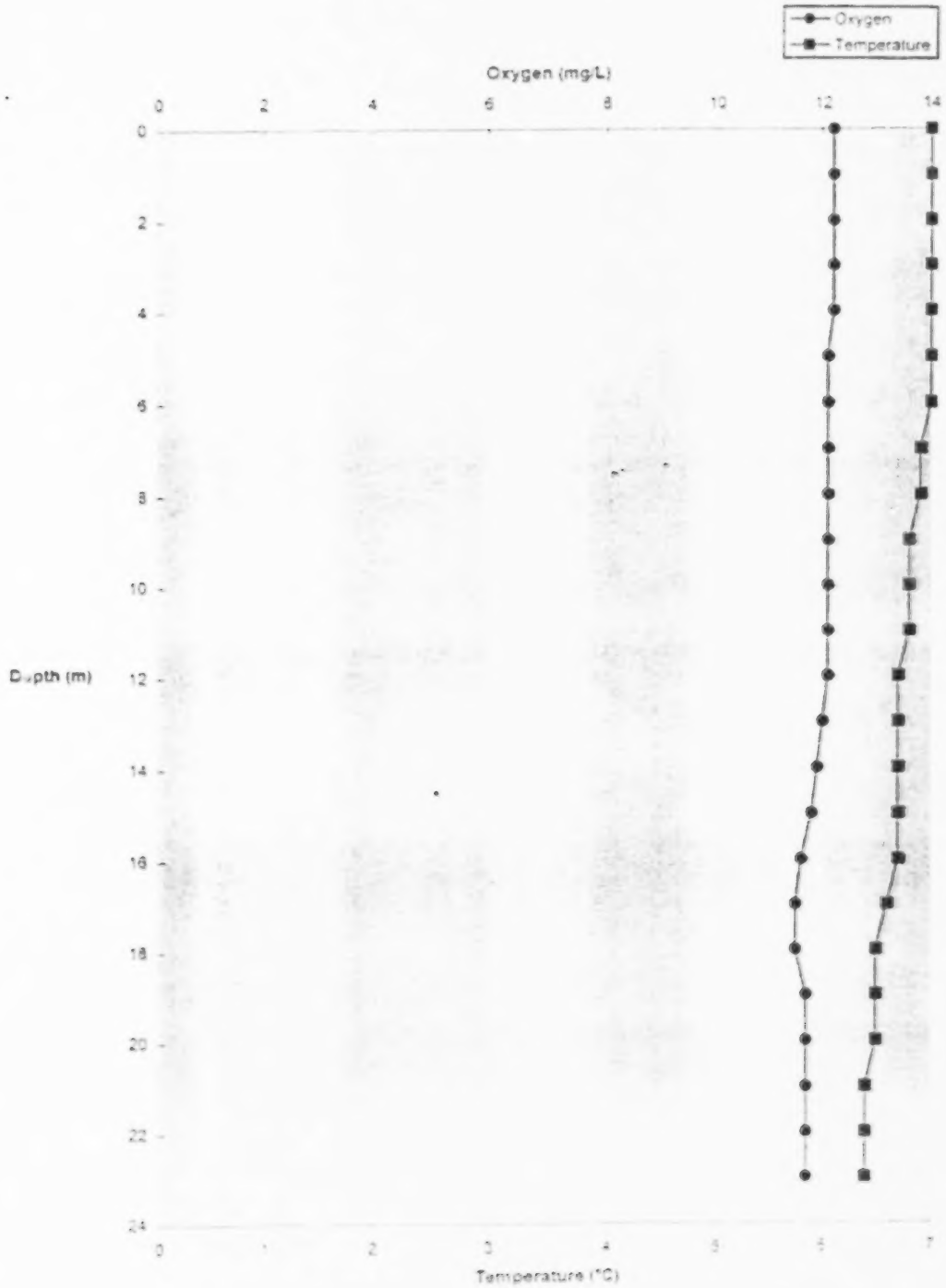
LAKE: Upper Tenakihi Lake

SUMMER OXYGEN / TEMPERATURE DATA

DEPTH (m)	02 (mg/L)	TEMPERATURE (°C)
Surface	12.2	7.0
1.0	12.2	7.0
2.0	12.2	7.0
3.0	12.2	7.0
4.0	12.2	7.0
5.0	12.1	7.0
6.0	12.1	7.0
7.0	12.1	6.9
8.0	12.1	6.9
9.0	12.1	6.8
10.0	12.1	6.8
11.0	12.1	6.8
12.0	12.1	6.7
13.0	12.0	6.7
14.0	11.9	6.7
15.0	11.8	6.7
16.0	11.6	6.7
17.0	11.5	6.6
18.0	11.5	6.5
19.0	11.7	6.5
20.0	11.7	6.5
21.0	11.7	6.4
22.0	11.7	6.4
23.0	11.7	6.4
24.0	Bottom	

* maximum lake depth is 25.0 m; however, a depth of 24.0 m was the maximum that was able to be found for performing the water chemistry

FALL OXYGEN / TEMPERATURE PROFILE



LAKE: Upper Tenakihi Lake

NETTING RECORD

Mesh Size Experimental Order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE # 1

Type:	Sinking Monofilament Gill Net			
Date Set:	September 24, 1996		Time:	1852 hrs
Date Lifted:	September 25, 1996		Time:	0847 hrs
Net Dimensions:	Length:	91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm		Depth:	1.5 m
			Substrate:	boulders
Deep End Mesh Size:	64 mm		Depth:	17.0 m
			Substrate:	thin silts over bedrock

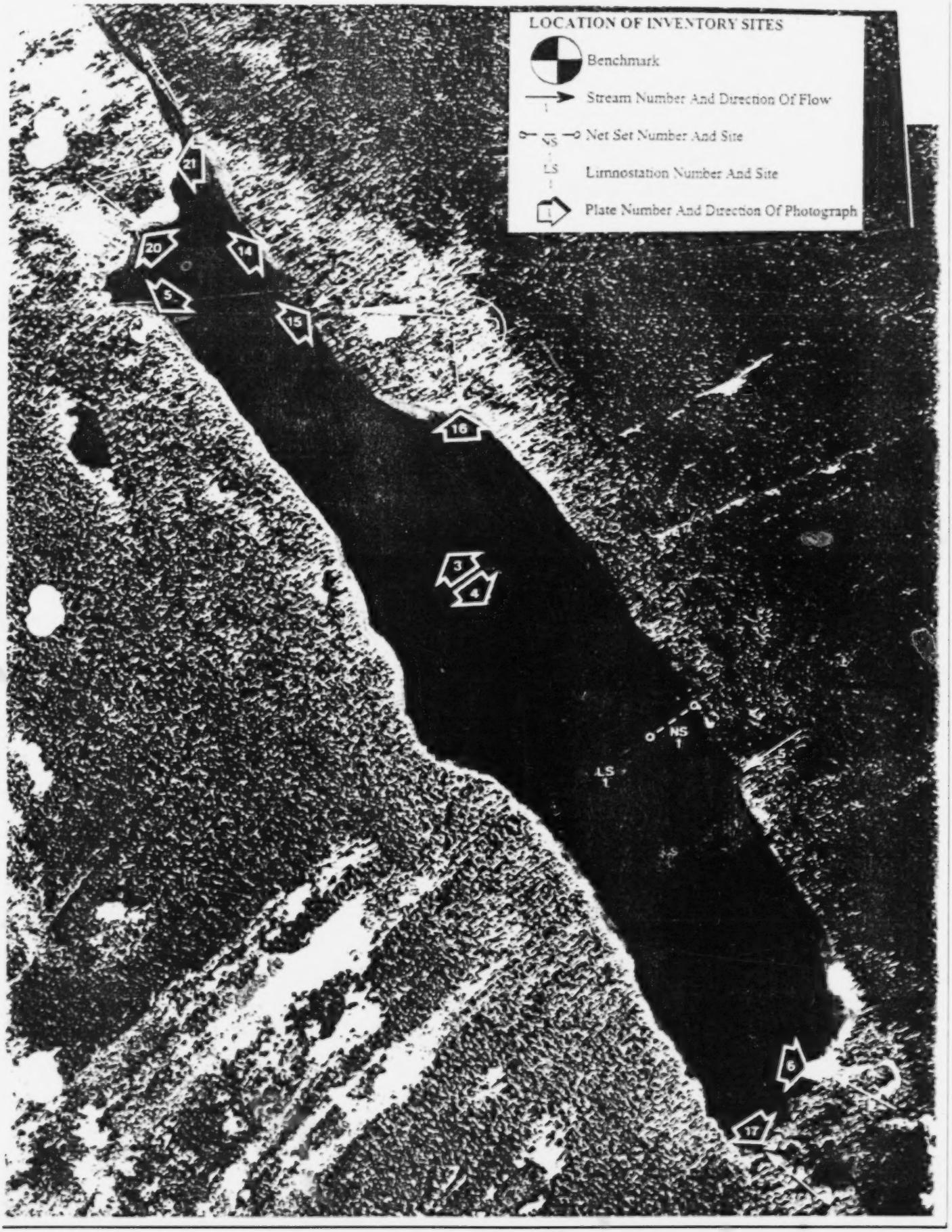
Comments: The net started approximately 2.5 m from the shore. The net was empty.

LAKE CATCH SUMMARY

Minnow Traps:

Bait: Sardines

Trap No.	Hours	Depth (m)	Substrate	Species	No. Caught	Size Range (cm)
1	14:03	0.8	fines with waterweed	empty	0	-
2	14:03	0.8	fines with waterweed	CC	1	8.2
3	14:02	1.0	fines and small gravel	Caddis Larvae	1	-
4	14:01	1.5	fines over LWD and cobble	empty	0	-


LOCATION OF INVENTORY SITES
Benchmark
Stream Number And Direction Of Flow
Net Set Number And Site
Limnostation Number And Site
Plate Number And Direction Of Photograph
21
20
14
5
15
16
3
4
NS
LS
6
17

LAKE: Upper Tenakihi Lake

PHOTOGRAPH DIRECTORY

Plate	Roll : Number	Description
1	31: 22	Aerial view of Upper Tenakihi Lake looking northeast.
2	31: 23	Aerial view of Upper Tenakihi Lake looking southwest.
3	32: 3 - 5	Panoramic view of Upper Tenakihi Lake looking northeast from the center of the lake.
4	32: 6 - 8	Panoramic view of Upper Tenakihi Lake looking southwest from the center of the lake.
5	32: 2	View of the benchmark located 2.0 m above present water level in a 32 cm diameter spruce tree that is 5.5 m from the present water's edge and located on the west-northwest side of the lake approximately 60 m from the northeast end of the lake.
6	32: 22	View of the mouth of Tenakihi Creek (Inlet # 1) where it enters Upper Tenakihi Lake on the southwest end of the lake.
7	31: 1	Upstream view of the sample site on Tenakihi Creek (Inlet # 1), taken approximately 285 m upstream of Upper Tenakihi Lake.
8	32: 23	Downstream view of the sample site on Tenakihi Creek (Inlet # 1), taken approximately 315 m upstream of Upper Tenakihi Lake.
9	32: 12	Upstream view of sample site # 1 on Tenakihi Creek (outlet), taken approximately 315 m downstream of Upper Tenakihi Lake.
10	32: 13	Downstream view of sample site # 1 on Tenakihi Creek (outlet), taken approximately 285 m downstream of Upper Tenakihi Lake.
11	34: 23	Downstream view of sample site # 2 on Tenakihi Creek (outlet), taken approximately 910 m downstream of Upper Tenakihi Lake.
12	31: 11	View of the mouth of Inlet # 2 where it enters Upper Tenakihi Lake on the east side of the lake near the outlet.
13	31: 9	View of the mouth of Inlet # 3 where it enters Upper Tenakihi Lake on the east side of the lake near the outlet.

LAKE: Upper Tenakihi Lake

14	31: 8	View of the mouth of Inlet # 4 where it enters Upper Tenakihi Lake on the southeast side of the lake.
15	32: 18	View of the mouth of Inlet # 6 where it enters Upper Tenakihi Lake in the southwest end of the lake.
16	32: 17	View of the mouth of Inlet # 7 where it enters Upper Tenakihi Lake in the northeast end of the lake.
17	32: 1	View of the mouth of Inlet # 8 where it enters Upper Tenakihi Lake in the northeast end of the lake.
18	32: 15	Upstream view of the sample site on Inlet # 8, taken approximately 85 m upstream of Upper Tenakihi Lake.
19	32: 16	Downstream view of the sample site on Inlet # 8, taken approximately 115 m upstream of Upper Tenakihi Lake.

LAKE: Upper Tenakihi Lake

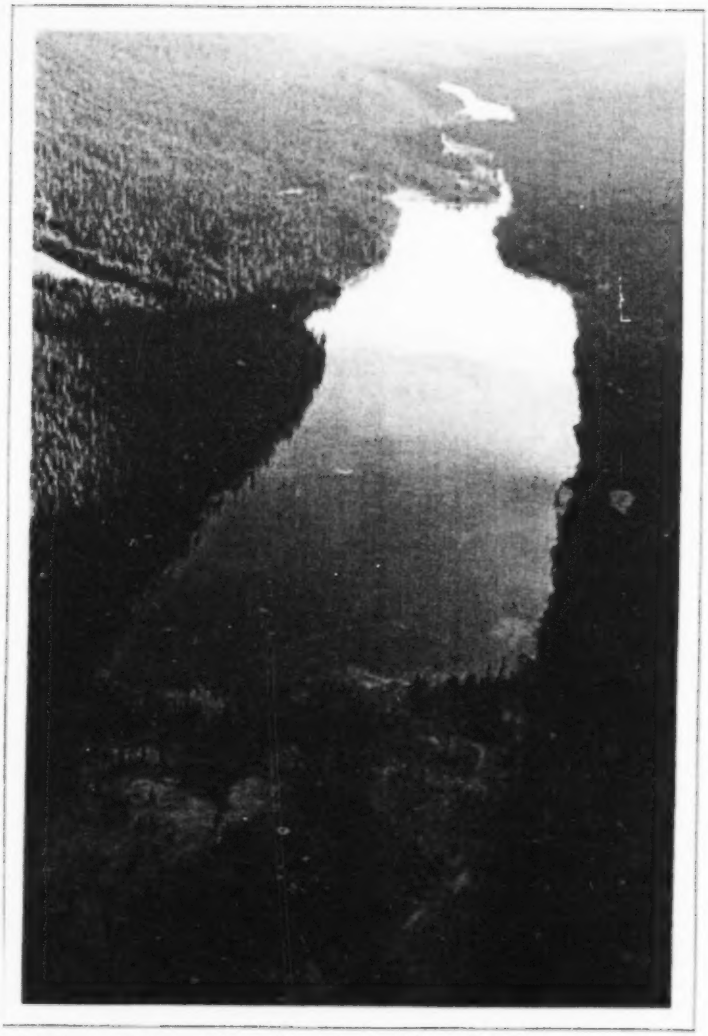


Plate # 1: Aerial view of Upper Tenakihi Lake looking northeast.

LAKE: Upper Tenakihi Lake

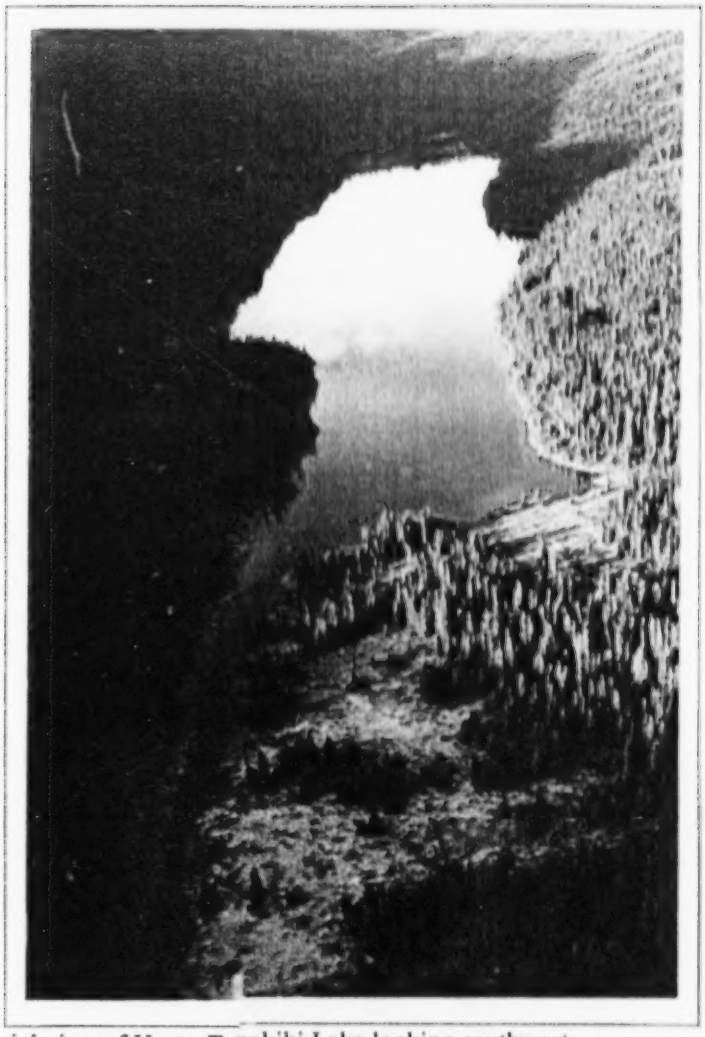


Plate # 2: Aerial view of Upper Tenakihi Lake looking southwest.

LAKE: Upper Tenakihi Lake

Plate # 3: Panoramic view of Upper Tenakihi Lake looking northeast from the center of the lake

LAKE: Upper Tenakihi Lake

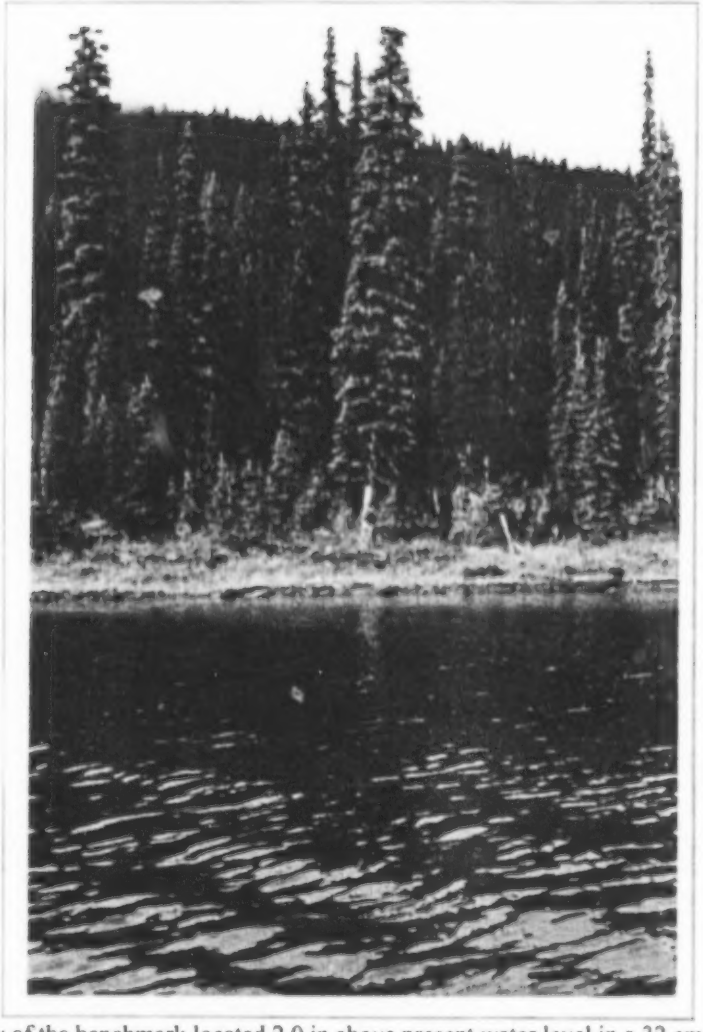


Plate # 5: View of the benchmark located 2.0 in above present water level in a 32 cm diameter spruce tree that is 5.5 m from the present water's edge and located on the west-northwest side of the lake approximately 60 m from the northeast end of the lake.

LAKE: Upper Tenakihi Lake

Plate # 4: Panoramic view of Upper Tenakihi Lake looking southwest from the center of the lake.

LAKE: Upper Tenakihi Lake

Plate # 6: View of the mouth of Tenakihi Creek (Inlet # 1) where it enters Upper Tenakihi Lake on the southwest end of the lake.

Plate # 7: Upstream view of the sample site Tenakihi Creek (Inlet # 1), taken approximately 285 m upstream of Upper Tenakihi Lake.

LAKE: Upper Tenakihi Lake

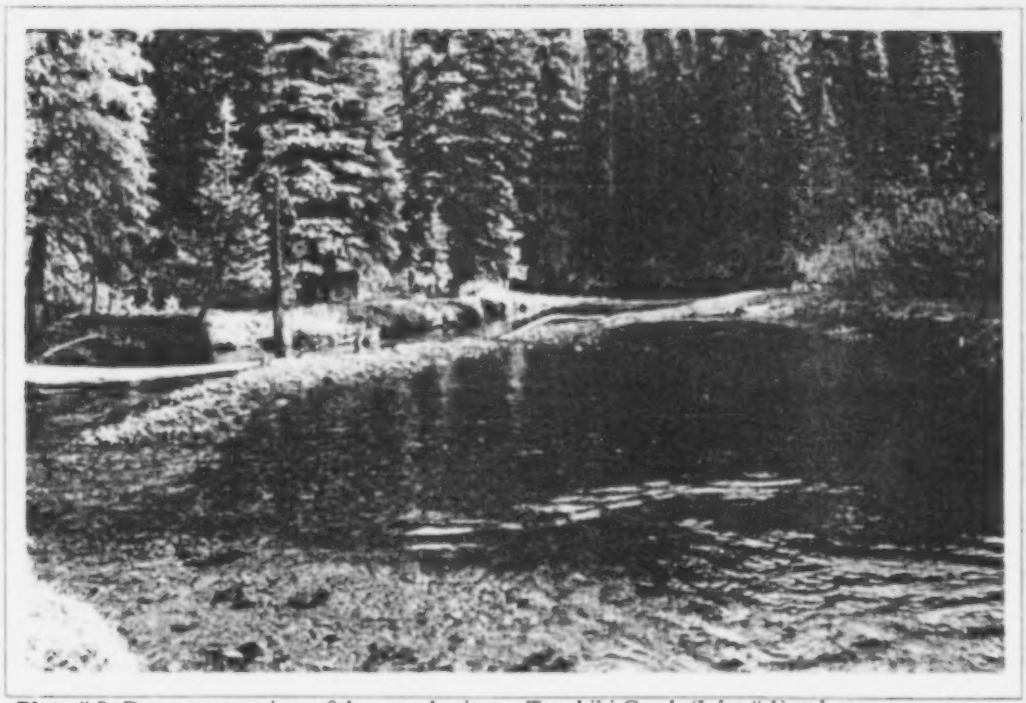


Plate # 8: Downstream view of the sample site on Tenakihi Creek (Inlet # 1), taken approximately 315 m upstream of Upper Tenakihi Lake.

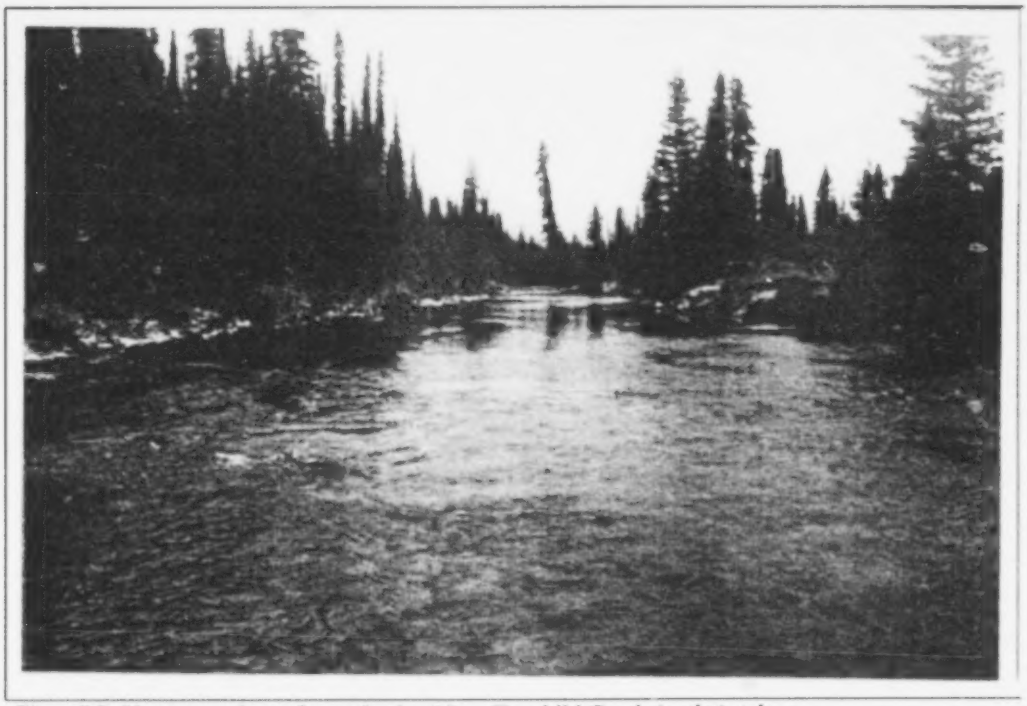


Plate # 9: Upstream view of sample site # I on Tenakihi Creek (outlet), taken approximately 265 m downstream of Upper Tenakihi Lake.

LAKE: Upper Tenakihi Lake

Plate # 10: Downstream view of sample site # 1 on Tenakihi Creek (outlet), taken approximately 235 m downstream of Upper Tenakihi Lake.

Plate # 11: Upstream view of sample site # 2 on Tenakihi Creek (outlet), taken approximately 1010 in downstream of Upper Tenakihi Lake.

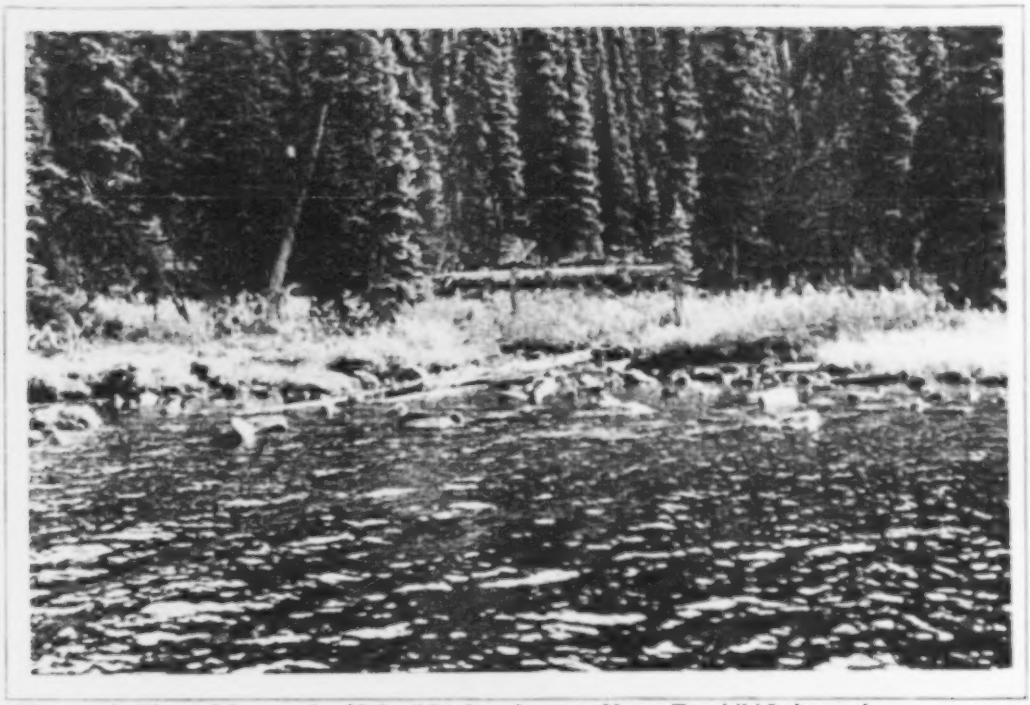


Plate # 12: View of the mouth of Inlet # 2 where it enters Upper Tenakihi Lake on the east side of the lake near the outlet.

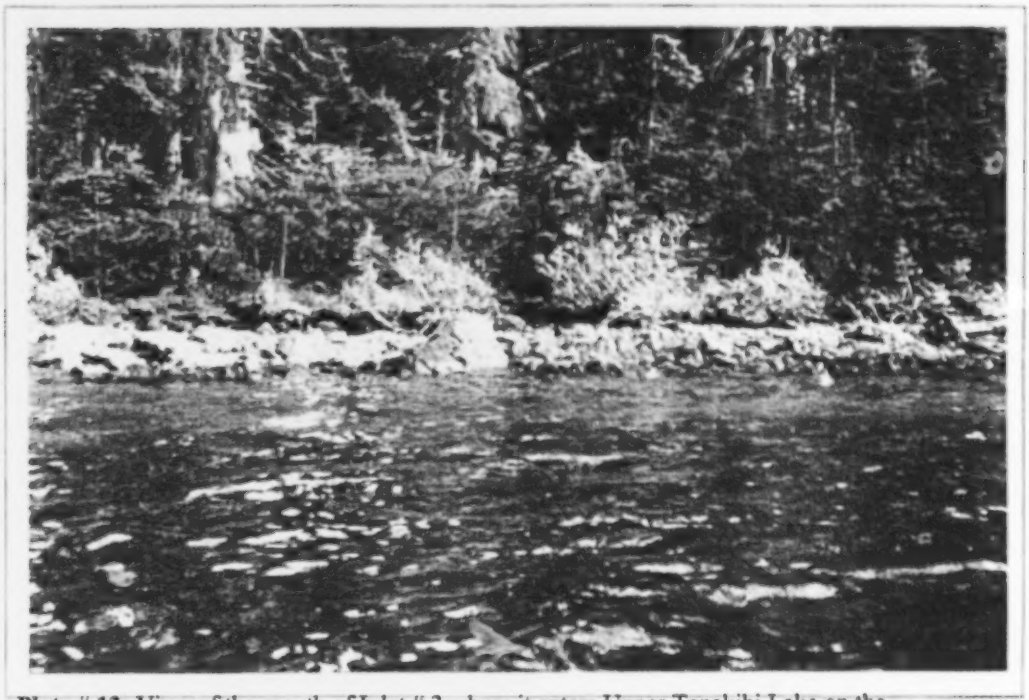


Plate # 13: View of the mouth of Inlet # 3 where it enters Upper Tenakihi Lake on the east side of the lake near the outlet.

LAKE: Upper Tenakihi Lake

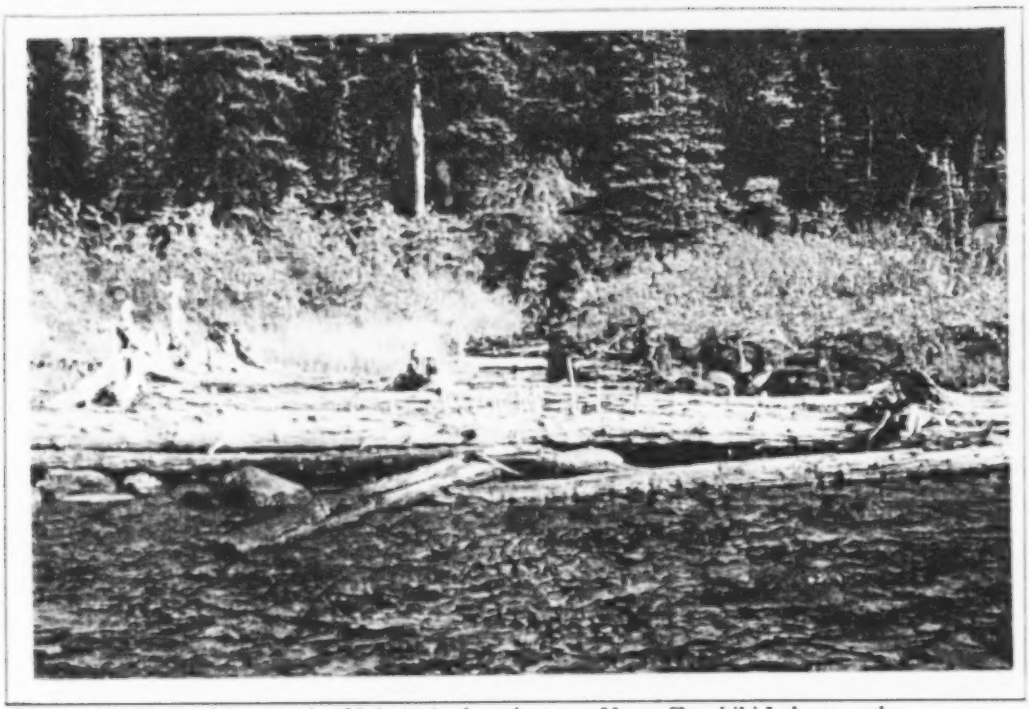


Plate # 14: View of the mouth of Inlet # 4 where it enters Upper Tenakihi Lake near the middle of the southeast side of the lake.

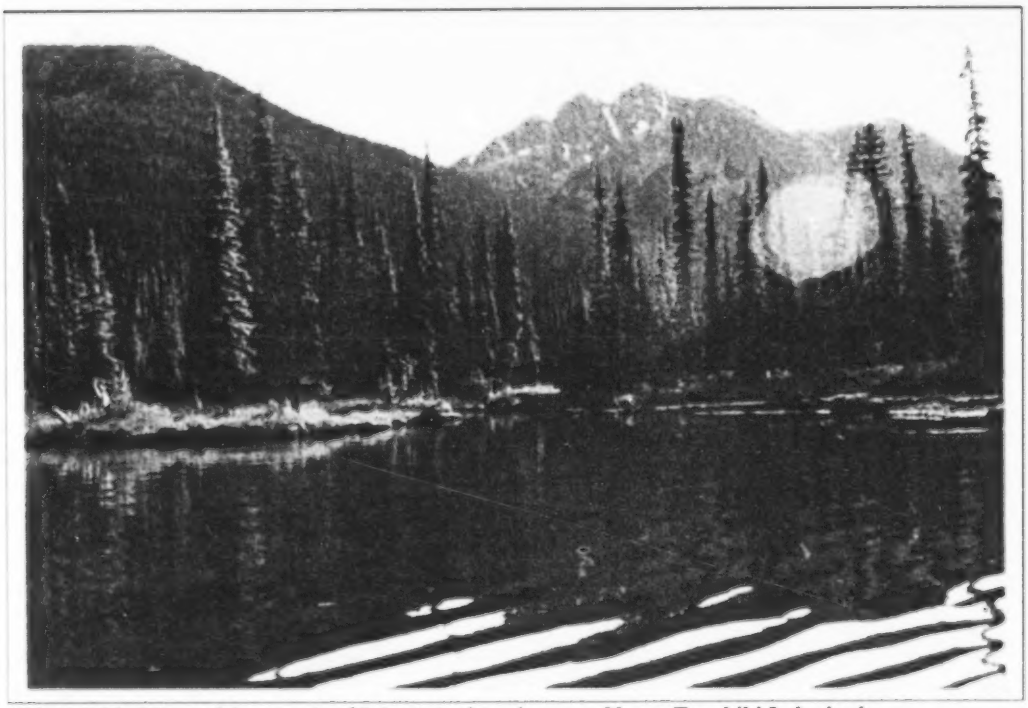


Plate # 15: View of the mouth of Inlet # 6 where it enters Upper Tenakihi Lake in the southwest end of the lake.

LAKE: Upper Tenakihi Lake

Plate # 16: View of the mouth of Inlet # 7 where it enters Upper Tenakihi Lake in the northeast end of the lake.

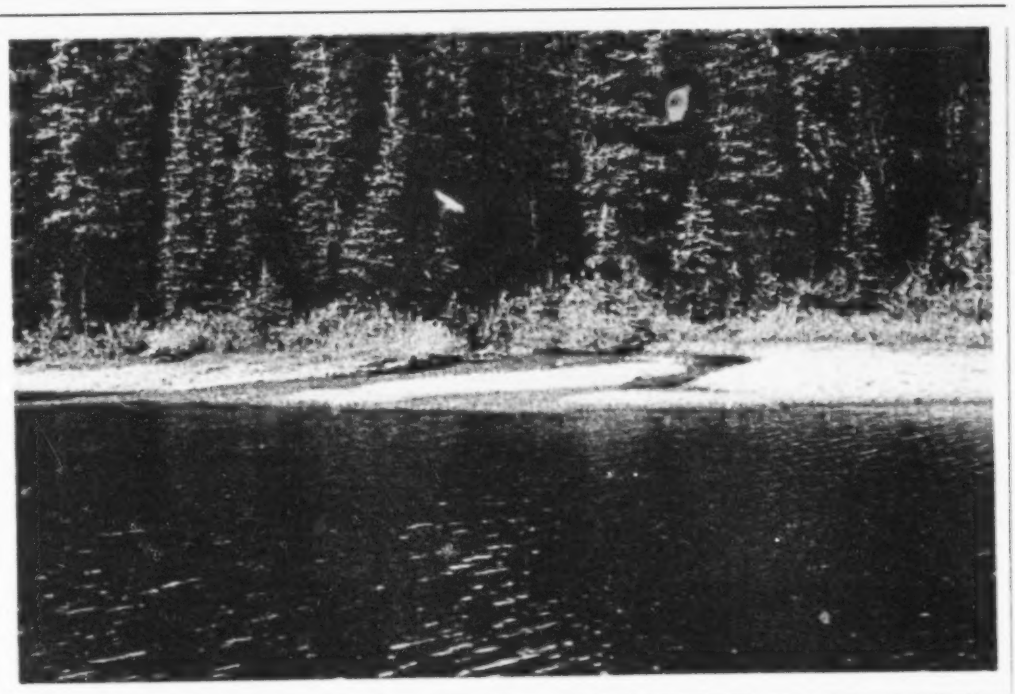


Plate # 17: View of the mouth of Inlet # 8 where it enters Upper Tenakihi Lake in the northeast end of the lake.

LAKE: Upper Tenakihi Lake

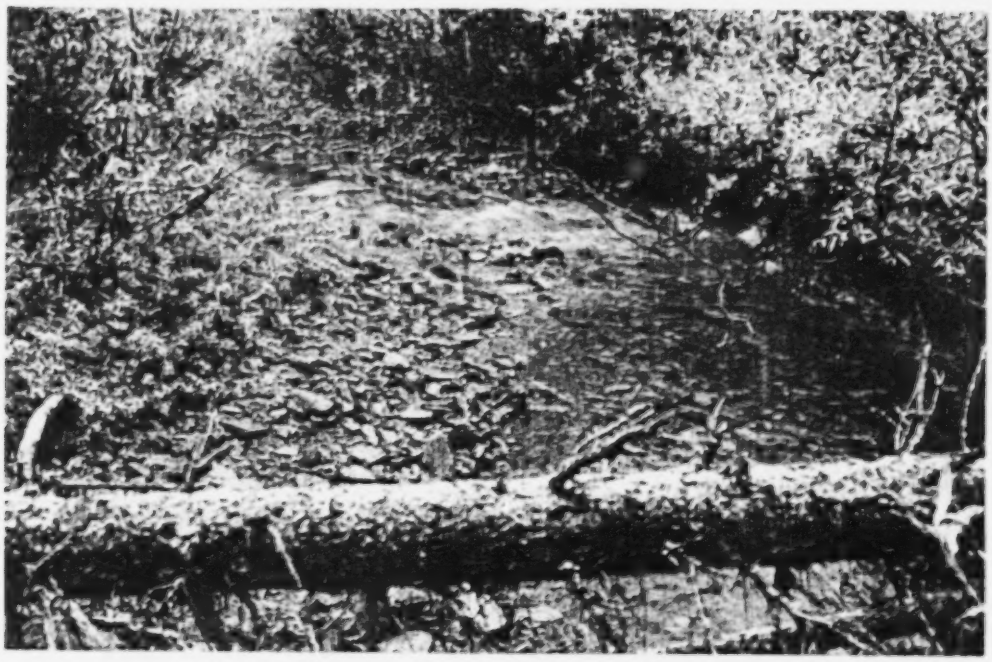


Plate # 18: Upstream view of the sample site on Inlet # 8, taken approximately 85 m upstream of Upper Tenakihi Lake.

Plate # 19: Downstream view of the sample site on Inlet # 8, taken approximately 115 m upstream of Upper Tenakihi Lake.

Appendix A

LABORATORY REPORT

Water Chemistry Analysis

RESULTS FOR UNNAMED LAKE-TENAKIHI LK SW SAMPLES

Parameter Analyzed		Units	965280-001	965280-002
ALKALINITY		mg/l	19.4	19.7
CONDUCTIVITY		uS/cm	50	51
METALS/TOTAL (WATER-ICP)	AG	mg/l	<.01	-
	AL	mg/l	<.06	-
	AS	mg/l	<.06	-
	B	mg/l	<.01	-
	BA	mg/l	.02	-
	BE	mg/l	<.001	-
	CA	mg/l	8.1	-
	CD	mg/l	<.006	-
	CO	mg/l	<.006	-
	CR	mg/l	<.006	-
	CU	mg/l	<.006	-
	FE	mg/l	.019	-
	K	mg/l	.1	-
	MG	mg/l	.9	-
	MN	mg/l	.002	-
	MO	mg/l	<.01	-
	NA	mg/l	.4	-
	NI	mg/l	<.02	-
	P	mg/l	<.1	-
	PB	mg/l	<.06	-
	SB	mg/l	<.06	-
	SE	mg/l	<.06	-
	SI	mg/l	1.28	-
	SN	mg/l	<.06	-
	SR	mg/l	.047	-
	TI	mg/l	<.002	-
	V	mg/l	<.01	-
	ZN	mg/l	<.002	-
NITROGEN/AMMONIA		mg/l	<.002	.002
/NITRITE		mg/l	< .002	<0.002
/NITRITE+NITRATE		mg/l	.001	.001
/TOTAL		mg/l	.02	.03
PH		Rel.U.	7.50	7.48
PHOSPHORUS/O-PO4		mg/l	.001	<.001
/TOTAL		mg/l	.002	<.002
/TOTAL DISSOLVED		mg/l	.004	.004
RESIDUE/FILTERABLE		mg/l	30	30
/NON-FILTERABLE		mg/l	<5	5
BC CLIENT STUDY CODE			20	20
SAMPLING AGENCY		EMScode	91	91
SITE IDENTIFIER/NUMBER			NOSITE	NOSITE
COLLECTION START DATE		y/m/d	96/09/25	96/09/25
UPPER DEPTH		metres	0.5	23
TEMPERATURE ON ARRIVAL		deg.C	4	4

Appendix B

Tributary Stream Data

D.F.O. / M.O.E. Stream Survey Form

DFO/MOE
STREAM SURVEY FORM

Stream Name: gaz: Tenakee Creek; local: Tenakee Creek (Inlet #1) | Access | Method

Watershed Code | Reach No. | Length (m)

Location: ~ 200 m. (1/8 mi) up Shoreline Rd (Tenakee Rd (Trail)) | Map # | UTM | Site No. | Site Length (m) 30

Date Y M D: 96 07 24 | Time | Agency | Crew: MM KH | Photos | Air Photos | Lat ° ' (N) | Long ° ' (W) | Photos | Misc

C	PARAMETER	VALUE	METH	SPECIFIC DATA
	Ave Chan Width (m)	2.5	FF	9.35 16.7 11.4
	Ave Wet Width (m)	2.3	FF	9.40 16.4 7.0
	Ave Max Riffle Depth (cm)	50	cm	35 40
	Ave Max Pool Depth (cm)	100	cm	100 110 78
	Gradient %	3	SC	

% Pool 50 | Riffle 20 | Rapids 0 | Other | GE

Side Chan % | 0 ☒ 0-10 ☐ 10-40 ☐ 140 ☐ GE

Debris: Amt % | 2 ☐ 0-5 ☒ 5-15 ☐ >15 ☐ GE | Stable % | GE

COVER Total % 30 GE

Cmpx Str 100%	Dp Pool	LOD	Boulder (>256mm)	Bdr rock	Cutbank
	35	45	0	0	20

Crown Closure % 5 E Assoc. SE

C	BED MATERIAL	%
	Fines (<0.06 mm)	50
	Gravels: small (2-16mm)	15
	Gravels: large (16-64mm)	10
	Cobbles (64-128mm)	15
	Large Cobbles (128-256mm)	10
	Boulder (>256mm)	0
	Bedrock (Al)	0

Dominant 15 E Codes: Artificial L (M) H

C	BANKS
1	Height (m) 24 Substrate 50
	Texture (F) (S) L R

Confinement: EN CO FC OC (VC) N/A

Valley Channel Ratio: 0-2 2-5 5-10 (10) N/A

Flood Stage (m): Dry L (M) H Flood

Flood Signs (m): Grasses (Y) N

Bars %: 20 Lat: Long:

Main Channel: Type: Length (m):

DISCHARGE

Parameter	Value	Metric	Specific Data
Wetted Width (m)	6.0	FT	3.0 6.4 6.3
Mean Depth (m)	0.3	Dm	0.22 0.22 0.35 Sandy
Mean Velocity (m/s)	0.4	Fpm	0.30 Visible Bedload Movement
Discharge (m³/s)	0.34	Cfs	

REACH SYMBOL
Plan:

Width Valley Channel Slope Pool Morphology

Surveyed by:

Date Y M D

FISH SUMMARY

C	Species	No	Size Range mm	Capture	Use	Method/Mort

STREAM/VALLEY CROSS-SECTION
Looking Downstream

L R

PLANIMETRIC VIEW

COMMENTS

Channel Stability Debris Management Concerns Obstructions Riparian Zone Valley Wall Processes Etc.

1 Undercut pool on left bank

2 Log jam with pool on left bank

Surveyed by:

Date Y M D

DFO / MOE
STREAM SURVEY FORM

Stream Name: (gaz) Tsuchah River — (local) 2nd bdg T. Hazelwood Ck — Access — Method

Watershed Code — Reach No. — Length(m)

Location: 300 m D/S Hazelwood Creek Bridge — Map # — Site No. — Measured — Flow

(i.e. SW) — UTM — Flow Card — Y — M — F — Field ☑ Hist ☐

Date Y M D — Time — Agency — Crew — Photos — Air Photos

C	PARAMETER	VALUE	METH	SPECIFIC DATA	OBSTRUCTIONS C	Hgt(m)	Type	Loc'n
	Ave Chan Width (m)	10.0	3E	14.2 12.4 14.5				
	Ave Wet Width (m)	14.5	3E	12.9 14.7 16.0				
	Ave Max Riffle Depth (cm)	30	3M	32 35 30				
	Ave Max Pool Depth (cm)	1	6M					
	Gradient %	1.3	2E					
	% Pool 0 Riffle 50 Other		2E					
	Side Chan % 0 ☒ 0-10 ☐ 10-40 ☐ 40+ ☐		2E					
	Debris Area % 0 ☒ 0-5 ☐ 5-15 ☐ 15+ ☐		2E					
	Debris Stable %		2E					
	COVER Total %	5	2E					
	Comp Bk Rock L O D Boulder Cobble Gravel Sand							
	100% 0 0 2.5 50 47.5 0							
	Green Cutbank % 25 E Algae 1 M							

C	BANKS				
1	Height (m) 0.5 Angle 45				
	Texture F S L G				
	Confinement EN CO FC OC UC N/A				
	Valley Chan'l Ratio 1-2 2-3 3-10 10+ N/A				
	Chan'l Stage Dry L M H Flood				
	Flood Signs (m/m) 0.5 Treated Y N				
2	Bank % 25 Length Azimuth				
	Water Temp °C Turbidity Cloud (JTU)				

DISCHARGE

Parameter	Value	Method	Sample Data
Wetted Width (m)	11.5	3E	12.4 11.0
Mean Depth (m)	0.2	2M	0.20 0.18 0.22 0.21
Mean Velocity (m/s)	0.4	1-2M	0.4 0.4 0.4 0.4 0.3 0.3 0.4 0.4
Discharge (m³/s)	0.63	1-2M	

HEALTH SYMBOLS

Width Valley Chan'l Ratio — Bed Material

Sheet ___ of ___

FISH SUMMARY

C	Species	No	Size Range (mm)	Capture	Use	Method/Ref

STREAM/VALLEY CROSS-SECTION
Looking Downstream

L — R

PLANIMETRIC VIEW

COMMENTS

Channel Stability — Debris — Management Concerns — Obstructions — Riparian Zone — Valley Wall Processes — Etc

1 Low-e to (0.5m) [illegible]

2 [illegible]

Recorder

Date Y M D

DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz): Tenakin Ck (local): Outlet To Unnamed Lk | Access | Method

Watershed Code | Reaching | Longitude | Latitude: 30

Section: ~ 95 m D/S of Unnamed Lk (Tenakin Lk 54) | UTM | Site No. | Elevation: 5 | Map: 92 O/6 E

Date Y M D: 96 08 20 | Time: 0930 | Agency | Crew: MH/Ron | Photos | Air Photos

C	PARAMETER	VALUE	METH	SPECIFIC DATA	OBSTRUCTIONS (C)	Hgt	Type	Loc'n
	Ave. Chan. Width (m)	17.3	ST	20.5 21.5 13.5				
	Ave. Wet Width (m)	11.5	ST	12.1 21.0 10.2				
	Ave Max Riffle Depth (cm)	28	WD	26 26 32				
	Ave Max Pool Depth (cm)	75	DM	61 55 48				
	Gradient %	1.5	TE					
	% Pool: Stable	40	GE					
	Side Chan %		GE					
	Islands: Area %		GE					
	Stable %	50	GE					
	COVER: Total %	5	GE					
	Overhang Bush 100%	60	30	0	50			
	Other: Debris %	0	ANGLE					

BED MATERIAL: Fines (<2mm) | Small (2-16mm) | Gravel: Large (16-64mm) | Small Cobble (64-128mm) | Large Cobble (128-256mm) | Boulder (>256mm) | Bedrock (R) | D_{50} cm 13 | Compaction: L M H

BANKS: Height: 0.3 | Undercut: 40 | Texture: 1 2 L A | Continuity: Ex CO PC SC UC N/A | Valley/Channel Ratio: 1:1 2:1 5:1 10:1 N/A | Stage: Dry L M H Flood | Flood Signs: Height: 1.0 | Debris: N | Main Trees: | Age: | Diameter:

Deer Trail DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	13.0	ST	12.0 13.3
Mean Depth (m)	0.3	DM	0.38 0.33 0.36 0.21 0.30
Mean Velocity (m/s)	0.3	DM	0.28 0.26 0.31 0.14 0.41
Discharge (m³/s)	0.78	EQN	

REACH SYMBOL: Fish | Width Index | Channel Slope | Bed Material

CP #18241

FISH SUMMARY

C	Species	No.	Size Range cm	Life Phase	Use	Method	Ref.

STREAM/VALLEY CROSS-SECTION — Looking Downstream — L — R

PLANIMETRIC VIEW

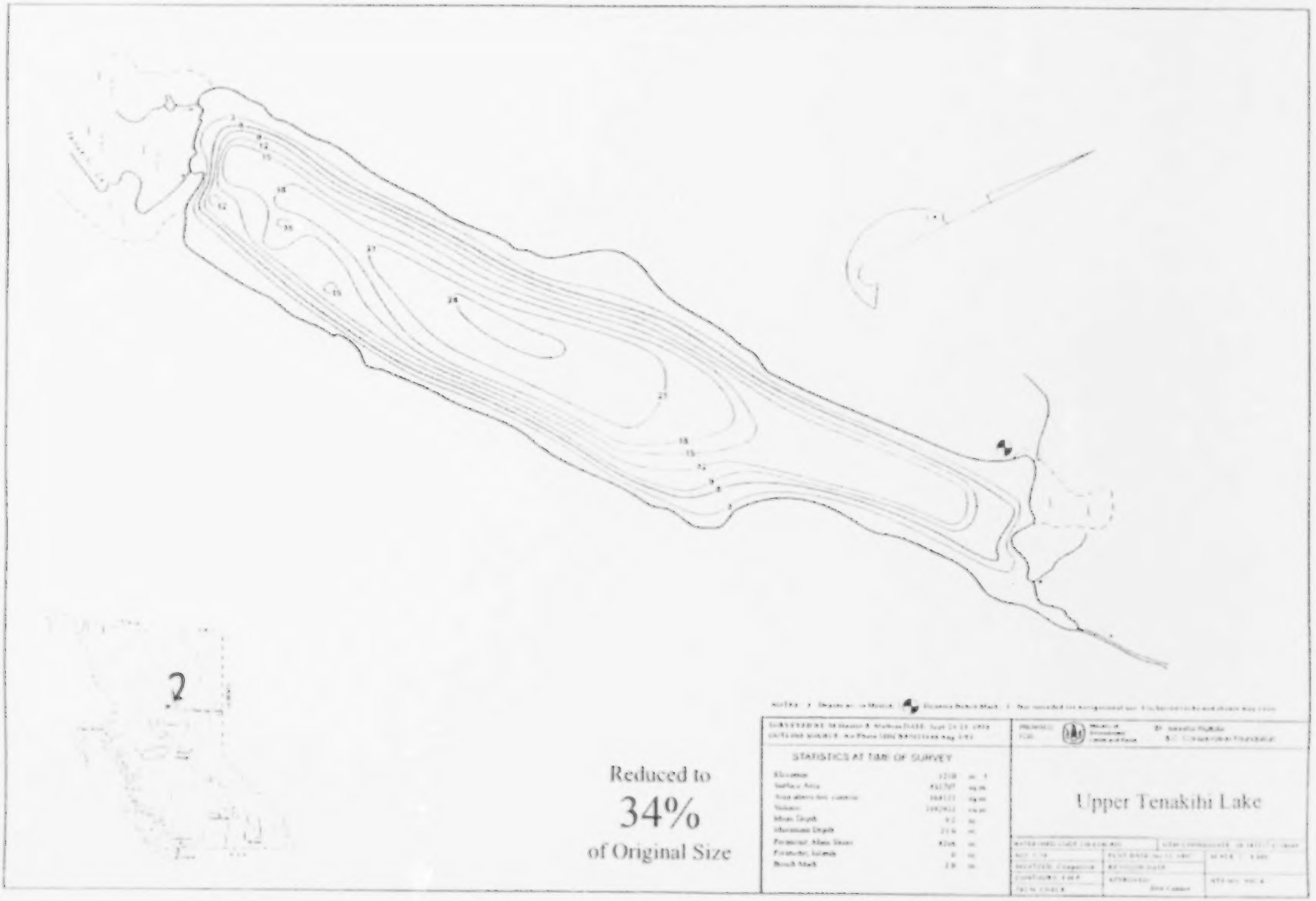
COMMENTS

Channel Stability ___ Debris ___ Management Concerns ___ Obstructions ___ Riparian Zone ___ Valley Wall Processes ___ Etc

1 - Upright channel in place w/ scarred, mature [illegible] surface cross section between.

Appendix C

BATHYMETRIC MAP



Reduced to
34%
of Original Size

STATISTICS AT TIME OF SURVEY

Upper Tenakihi Lake